

# U.S. Marine Sanctuaries System

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The National Marine Sanctuary Program Resource Classification System (Sanctuary Programs Office, 1982) is used by the United States to consolidate, code, and facilitate analysis of data acquired on marine sites being evaluated as possible marine sanctuaries. The classification system performs several functions by using exist-

ing baseline resource data:

- Identifying (1) representative ecosystems and processes, (2) major geological, physical, chemical, and oceanographic features, and (3) unique or ecologically significant characteristics of coastal and marine systems of the United States

- Locating sites that best represent these ecosystems, features, or characteristics
- Describing the human uses of these ecosystems, features, or characteristics

The scheme resembles Ray's. It is computer-compatible and permits the addition of new

classification categories without the need for renumbering existing ones. This should prove to be a workable and valuable scheme. For example, "II.A., 1., e.(2)(j), 8.(1)(h), b.(2)" indicates that the site is between Cape Cod and Cape Hatteras, represents an oyster reef habitat, and is important as a commercial shellfish species area:

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Zoogeographic region	II.A	North Temperate and Boreal-Austral
Coastal biotic province	1.	Temperate Atlantic
Resource value	e.(2)(j)	Virginian
	8.(1)(h)	Benthic invertebrates
Human use value	b.(2)	Oyster reefs
		Shellfishing areas

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## National Marine Sanctuary Program Resource Classification

I. *Tropical Warm Water Shelf Provinces*. Less than 200 m in depth. Dominated by mangroves, coral reefs, and associated biota. Tropical and subtropical regions included: tropical between the 20C isotherms and subtropical extending to about 16 to 18C. Barriers between provinces and subregions are land masses. In the past (i.e., Mesozoic through early Tertiary) the entire area was joined by the great Tethys Sea; thus there is some biotic similarity throughout.

A. *Central and Western Pacific Basin, Indo-Pacific-Tropical Insular Pacific*. High and low islands, mostly of volcanic origin, considerable wave action, endemic tropical and subtropical biota, although the biota becomes somewhat impoverished as one progresses eastward from the Indo-Malayan center. Includes Guam and the Northern Mariana Islands, and Trust Territories of the Pacific Islands, the Samoa Islands, and the Hawaiian Archipelago.

1. *High Islands*. Precipitous mountains of volcanic origin, rocky sea fronts, high energy beaches, high velocity channels, inland water ecosystem (coastal wetlands, streams,

and pools), shoreline ecosystems (estuaries, rocky beaches, shallow lava beaches, boulder habitats, marine tide pools, sandy beaches, mud flats, and mangroves), and offshore ecosystems (coral reef flats, protected coral communities, sand deposits and channels, and deepwater terraces and slopes).

2. *Low Islands*. Formed by geological subsidence of volcanoes. Gradual slopes, low energy beaches, steep shoreline cliffs, high velocity channels, shoreline ecosystems (horizontal faces, boulder habitats, marine tide pools, mangroves) and offshore ecosystems (atolls, coral reef flats, protected coral communities, sand channels, deepwater terraces and slopes).

B. *American Atlantic and East Pacific Tropical Subtropical*. The Isthmus of Panama did not separate the two American coasts until relatively recently in geologic time (the Tertiary) so that they have considerable similarities.

1. *Floridian-West Indian*. Eastern coast of tropical North America (including Cape Canaveral to Key West,

the Tortugas, Sanibel Island, and Florida, and the U.S. Virgin Islands and Puerto Rico in the West Indies). Continental shelf is narrow off the east coast of Florida and the islands and wide off the west coast of Florida. Coastal plain is wide off Florida, other areas are insular. Coasts are fringed by extensive sandy beaches and barrier islands with extensive wetlands dominated by mangroves. Shoreland is low lying (karst) limestone to mountainous, but distinctly calcareous, often of biological origin. Living reefs are common in nearshore areas and second in species richness only to the Indo-Malayan, but not nearly so rich in corals as the latter. Tropical waters are generally clear, of Caribbean and Antillean origin. Continental landmass influence justifies designating subprovinces: (1) the Floridian subprovince, from Cape Canaveral south to Key West and the Tortugas and Sanibel Islands; and (2) the American (Atlantic) Antillean subprovince of the West Indies (Figure 111).

2. *Louisianian-Gulf of Mexico*. Northern coast of the Gulf of Mexico, west central Florida from Sanibel Island to south Texas. Quite similar to the Carolinian-South Atlantic region, but more tropical in environment and in biotic composition. Continental shelf is wide, sediments mostly terrigenous. Coastal plain is wide and fringed by sandy beaches, barrier islands, and wetlands. Salt domes are common, some bearing living coral. Shelf waters are moderately turbid, more so near the Mississippi River.
3. *Carolinian-South Atlantic*. Coast of south Atlantic states from Cape Hatteras to Cape Canaveral, with the area of the Georgia Embayment south to Palm Beach transitional to the Floridian-West Indian region.

Continental shelf is wide and gently sloping with infrequent outcrops of lime rock banks, and bordered by the deep Blake Plateau. Coastal plain is wide, fringed by sandy beaches, sandy (silica) barrier islands, and extensive wetlands and (cypress) swamps. Carbonate sands are common both southward and seaward of the coast. Nearshore waters are highly productive and turbid with a high load of terrigenous sediment. Submerged aquatic vegetation is limited in distribution nearshore and associated with hard bottoms offshore. Temperate biota, with subtropical reef forms associated with hard banks, although reef-building corals are generally lacking. Salinity of ocean waters is greater than 35 parts per thousand (ppt), except where freshwater influence is great, and waters are strongly influenced by the Gulf Stream. Shoreline characteristics, terrestrial landforms, and oceanic influences suggest two distinct subregions, the Carolina Capes and the Georgia Embayment.

4. *Californian-Subtropical American Eastern Pacific*. Western coast of North America (including Point Conception, California, and Gulf of California to the California-Mexico border). Fairly well developed continental shelf containing the Channel Islands. Nearshore submarine canyons and baymouth barriers of moderate to small size are common coastal features. Shoreland is generally mountainous (often volcanic); rocky coasts with volcanic sand; general absence of marshes, swamps, and calcareous bottoms. Ocean waters are of southern origin; entire region characterised by upwelling. Biota is transitional from temperate Eastern Pacific to tropical Eastern Pacific; high degree of endemism. Southern border espe-



**Figure 111.** The Looe Key National Marine Sanctuary (Florida, USA) is an example of coral reefs of the Floridian-West Indian province. (Photo courtesy of U.S. National Oceanic and Atmospheric Administration.)

cially subject to change by reason of north-south current shifts.

II. *North Temperate and Boreal-Austral.* Temperate regions are the most variable of all seas, being tropical in temperature in summer and falling to almost polar temperatures in winter, especially inshore. Thus, the biota varies seasonally and boundaries are very hard to define.

A. *Temperate Atlantic.*

1. *Virginian-Mid-Atlantic.* Warm temperate western Atlantic from Cape Cod to Cape Hatteras. Continental shelf is uniformly wide, cut by submarine canyons at outer edge. Coast is unglaciated, fringed by siliceous sandy beaches and barrier islands. Coastal plain becomes increasingly wide to the south and indented by very large estuaries with extensive submerged aquatic

vegetation. Lowland streams, coastal marshes, and muddy bottoms become prominent. Nearshore waters receive moderate load of sediment from land areas. Some winter icing occurs in protected areas. Very complex hydrology; ocean waters generally originate in the north, with salinity less than 35 ppt, but occasionally replaced by some saline slope water and water of the Gulf Stream. North and south boundaries of the region are hard to define: roughly Cape Hatteras to about Cape Cod, but neither is a precise boundary. Boundary is variable seasonally. Coastal Labrador Current forms a "cold wall" between much of the coast north of Cape Hatteras and the Gulf Stream. Climate, topography, and biota transitional between Carolinian and Acadian; biota primarily temperate with some boreal species.

2. *Acadian-Boreal.* Cold temperate and boreal American North Atlantic. Northeast coast of North America (including Maine to Cape Cod, Massachusetts). Rocky, glaciated shoreline and submarine topography with deep basins prominent. Sandy beaches are common along the southern shores of the Gulf of St. Lawrence and in the southern portion of the region. Complex and fluctuating interrelationships between the Labrador Current and Gulf Stream. Waters are relatively clear, subject to winter icing. Ocean waters have less than 35 ppt salinity, originating mostly from the Labrador Current and St. Lawrence River. Boundaries of region difficult to delineate: Cape Cod to Newfoundland appears to be boreal and Newfoundland to arctic is transitional, but none are precise boundaries. Biota is essentially boreal, with large attached algal species as important producers.

B. *Great Lakes of North America*. Includes the U.S. portion of the Great Lakes and their connecting waters. Rocky, glaciated topography with limited wetlands. Cold temperate climate. Fresh-water only. Biota is a mixture of boreal and temperate species together with anadromous and marine invaders.

C. *Temperate North Pacific*. Incorporates a vast area of the North Pacific.

1. *Oregonian (Columbian)-Temperate Eastern Pacific*. Northwest coast of North America including the Washington-Canada border to Point Conception in southern California. Continental shelf is narrow; shorelands rocky and mountainous with rocky headlands and sandy pocket beaches. Many small and some large rivers. Estuaries are generally small with baymouth barriers, with the exception of San Francisco Bay and Puget Sound. Waters are cool and relatively clear; ocean waters dominated by California Current. Biota is boreal to temperate with extensive algal communities, especially offshore kelp beds.

2. *Sitkan-North Pacific*. From British Columbia to the base of the Alaskan peninsula (including the southern coast of Alaska). Continental shelf is generally narrow. The coast is incised, rocky, and dominated by glacial fjords, except in the central section from Prince William Sound to Glacier Bay, where many sand beaches and baymouth barriers occur. Precipitous coastal mountains are glaciated heavily in the north. Deep tidal estuaries with moraines (glacial debris) and turbid backwash. Uniformly cool temperatures. Ocean waters are cold temperate; biota is boreal to north and west.

3. *Aleutian-Insular North Pacific*. From the base of the Alaska Peninsula throughout the Aleutian, Pribilof, and Kommandorski Islands. Conti-

nental shelf narrow or absent. Shorelines precipitous, dominated by north Pacific weather and oceanic influences. Ocean waters are north Pacific in origin; very little fresh-water input. Biota is boreal.

III. *Arctic-Boreal/Arctic*. From the southern Bering Sea to the Chukchi and Beaufort Seas and the archipelago of the Canadian Arctic. Continental shelf and coastal plain width moderate to wide. Sea surface and shores subject to ice stress and scouring most of the year. Floating ice common. Shores often cliffed. Coastal landforms varied, including large deltas with extensive wetlands, large lakes and lagoons, and long barrier islands and beaches. Ocean waters westward and southward originate in north Pacific and are strongly influenced by the Yukon and Kuskokwim Rivers; to the east and north, the MacKenzie River has influence. A biotic boundary at Point Barrow demarcates two marine subregions: the Boreal-Arctic Bering and Chukchi Seas, and the Arctic Beaufort Sea. Biota is boreal and dominated by marine mammals and marine birds. Extremely productive shelf waters; diatoms inhabit ice, in and on undersurface, and phytoplankton are often present.

IV. *Oceanic Bathypelagic and Benthic Deep Sea*. Certain regions are mostly outside our purview, but we must be conscious of them. These include northern warm water and southern cold water oceanic regions; the bathypelagic seas, mostly poorly lit; and the archibenthic and abyssal benthic deep sea. In the deeper regions lives a partly archetypal, peculiarly specialised biota, highly dependent on production in nearsurface waters and consequently the "rain" of detritus to great depths. Water mass characteristics, more than any other features, delimit these regions, and the nature of the benthic sediments has powerful influence on the benthic forms.

## Classification by Type of Sanctuary

The following categories are also part of the National Marine Sanctuary Program Resource Classification Systems. (Note that characteristics may overlap.)

### Area of exceptional resource value

- a. Area that is particularly characteristic of the broad biogeographic region in which it is found
- b. Area that is particularly characteristic of the biogeographic subregion in which it is found
- c. Area that is significant for the diversity of ecological communities found in a specified habitat type or biogeographic region or subregion
- d. Area that is significant for biological productivity
- e. Area that is significant for biotic character or species representation
  - (1) Area with rare, threatened, endangered, depleted, or endemic species or species of limited geographic range
  - (2) Area with ecologically important marine species
    - (a) Cetaceans (whales and porpoises)
    - (b) Pinnipeds (seals and sea lions)
    - (c) Polar bears
    - (d) Sea otters
    - (e) Manatee and dugong
    - (f) Marine turtles
    - (g) Pelagic finfish
    - (h) Demersal finfish
    - (i) Cryptic finfish
    - (j) Benthic invertebrates (e.g., shellfish, coral, and sponges)
    - (k) Deepwater species
    - (l) Marine birds
    - (m) Marine plants
    - (n) Marine microorganisms (e.g., phosphorescent bays and red tides)
  - (3) Area with unique species associations or biological assemblages
    - (a) Kelp-sea urchin-abalone-sea otter association
    - (b) Scleractinian coral-algae association
    - (c) Submarine canyon "pueblo" community
    - (d) Red tides
    - (e) Phosphorescent bays
    - (f) Others
- f. Area important for species maintenance
  - (a) Courtship areas
  - (b) Breeding grounds
  - (c) Feeding grounds
  - (d) Nesting/nursery areas
  - (e) Haul-out areas
  - (f) Resting/wintering areas
  - (g) Migratory pathways
- g. Area characterised by special ecosystem structure (i.e., physical, chemical, and/or geological habitat features)
  - (1) Coast-associated habitats
    - (a) Estuaries
      - i. Mixoeuhaline (30 to 35 ppt)
      - ii. Polyhaline (18 to 30 ppt)
      - iii. Mesohaline (5 to 18 ppt)
      - iv. Oligohaline (0.5 to 5 ppt)
    - (b) Fjords
    - (c) Sedimentary deltas
    - (d) Hypersaline lagoons
    - (e) Bays
    - (f) Marshes
    - (g) Mangroves
    - (h) Oyster reefs
    - (i) Worm and clam flats
    - (j) Submerged vegetation beds
    - (k) High velocity channels
    - (l) Living coral reefs
  - (m) Soft bottom habitats
    - i. Intertidal sand bottom communities
    - ii. Intertidal mud bottom communities
    - iii. Subtidal sand bottom communities
    - iv. Subtidal mud bottom communities
  - (n) Hard bottom habitats
  - (o) Rocky intertidal algal communities
  - (p) Cypress swamps
  - (q) Migrating subsystems (migrations cued by seasonal food abundance)
  - (r) Plankton bays
  - (s) Coastal cliffs
- (2) Offshore Habitats
  - (a) Soft bottom habitats
  - (b) Kelp beds
  - (c) Coral and algal reefs

- (d) Atolls
- (e) Drowned reefs (including submerged shorelines, rocky outcrops, snapper banks, and “live bottoms”)
- (f) Insular environments (including bird/mammal islands)
- (g) Submerged vegetation beds
- (h) Sponge communities
- (i) Shellfish beds
- (j) Submarine canyons
- (k) Sand banks and shoals
- (l) Upwelling areas
- (m) Topographic highs
- (n) Naturally deep holes
- (o) Artificial reefs and structures
- (p) Transition zones
- (q) Migrating subsystems
- (r) Continental shelf/slope environments
- (s) Continental slope environments
- (t) Offslope environments (e.g., oceanic bathypelagic, abyssal plains, submarine trenches, seamounts, and submarine ridges)
- (u) Ice environments (e.g., shore fast, pack, shelf, glacial and berg)
- (v) Water circulation bodies (e.g., currents, circulation cells, gyres)
- (w) Pelagic ecosystems (independent of the bottom)

**Area of exceptional human use value**

- a. Area of importance for recreational fisheries
- b. Area of importance for industry or the military
  - (1) Fishing areas

- (2) Shellfishing areas
- (3) Mining areas
- (4) Facility siting areas
- (5) Transport areas
- (6) Other
- c. Area of importance for recreational activities other than fishing
  - (1) Diving areas
  - (2) Boating areas
  - (3) Nature study areas
  - (4) Shoreline water contact sport areas (such as swimming, surfing, and water skiing)
  - (5) Aesthetic areas
    - (a) Scenic seascapes
    - (b) Submerged scenic areas
  - (6) Wilderness areas
- d. Area of exceptional research opportunity (pure or applied research)
  - (1) Ecosystem analysis
  - (2) Specific species research (such as feeding habits or biochemistry of a marine organism)
  - (3) Marine geology
  - (4) Physical oceanography
  - (5) Chemical oceanography
  - (6) Resource monitoring
  - (7) Other
- e. Area of exceptional interpretive opportunity
- f. Area of historical, archaeological, or palaeontological importance
  - (1) Historic wrecks
  - (2) Human artifact sites
  - (3) Human archaeological sites
  - (4) Life-style support areas